



Reopening Brazil's Highway BR-319 puts Amazon ecosystems and Indigenous peoples at risk.

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The Amazon's road to deforestation

Brazil's Amazon region is undergoing a period of environmental setback, during which large infrastructure projects are being pushed forward and environmental protection is being reduced (1). One of these projects is the reopening of Highway BR-319, which was built in 1973 but abandoned in 1988. The road connects Porto Velho, located in an area of abundant deforestation, to Manaus in the heart of the Amazon rainforest (2, 3). With BR-319 and its planned side roads open to traffic, the deforested area would likely increase to more than 1200% of the 2011 level by 2100 (2). The road and related deforestation would affect 63 official Indigenous lands, which are home to 18,000 Indigenous people (3). The huge block of forest opened to deforestation by these roads contains a carbon stock that, if released, would greatly increase the chances that global mitigation efforts will fail to contain climate change (4).

A judicial decision that is no longer subject to appeal ruled that environmental studies must be carried out before paving a part of the highway designated as "lot C" (5). However, on 24 June, the federal government opened bidding for paving this stretch of road (6). Brazil's Federal Public Ministry characterized this breach of a judicial decision as "bad faith" and an "affront" to the judiciary (7). The justification by a representative of the executive branch was that

the paving would not cause an increase in the traffic on the highway (8), an opinion without any technical basis. Paving highways in the Amazonian interior has been shown to increase the number and size of vehicles and to result in increased migration, land speculation, and deforestation (9–11).

The failure of the government to abide by the judicial decision will set a dangerous precedent for other mega-developments in the Amazon, including hydroelectric dams and the Barão do Rio Branco project, which would build a road through a series of areas protected for traditional peoples and for biodiversity (12). If Highway BR-319 is paved before the required environmental studies have been conducted, it will be a decisive indicator of Brazil's reluctance to comply with its commitments under the climate and biodiversity conventions, and it will likely accelerate anthropogenic climate change.

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Smoke pollution's impacts in Amazonia

The combination of increasing Amazon deforestation and the specter of drought now threatens widespread fire and respiratory health risks that could worsen the coronavirus disease 2019 (COVID-19) pandemic, endangering all Amazonians, but particularly vulnerable traditional and rural peoples (1, 2).

Deforestation in the Brazilian Amazon between January and June (3070 km²) was 25% higher than it was during the same period in 2019 (2446 km²) and 46% higher than the 4-year average of January through June from 2016 to 2019 (2108 km²) (3). Within Indigenous lands, which make up 23% of the Brazilian Amazon (4),

deforestation quadrupled in the past 4 years (from 105 km² in 2016 to 497 km² in 2019) (5). Fire is intrinsic to the deforestation process—forest is left to dry after cutting and then burned to prepare for agriculture. The majority of deforested land in 2020, and 45% of the trees cut in 2019, has remained unburned (4). Between July and December this year, under dry conditions, most of this land will be set ablaze (6).

Current indices predict a severe western Amazon drought in mid- to late 2020 (2). In drought years, deforestation fires often escape into surrounding forest understories. The smoke arising in large quantities from both deforestation and understory fires is extremely toxic, causing shortness of breath, coughing, and lung damage. Fires in the Amazon are responsible for 80% of increases in fine particulate pollution (PM_{2.5}) regionally, affecting 24 million Amazonians (7). The likely relationship between air pollutants linked to fire, such as PM_{2.5}, and COVID-19 infection (8, 9) suggests that fire could aggravate the current COVID-19 crisis in Amazonia, where infection rates are already high (1 in 100 in June) (10). Indigenous peoples are at particular risk, given that they are currently suffering COVID-19 mortality rates that are 1.5 times the Brazil-wide average (11).

To avoid a combination of smoke and COVID-19 that could be catastrophic, Brazil must repeat in 2020 its past successes as an international leader curbing

deforestation and fire (12). A moratorium on deforestation and associated burning in at-risk areas and strong enforcement from current infrastructure are urgently needed.

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Investors can help rein in Amazon deforestation

The Brazilian Amazon—the largest tropical rainforest in the world—has reached its highest level of deforestation since 2008 (1). In 2019, 10,897 km² of land were deforested, a 50.7% jump over the previous year (1). A combination of threats, including tens of thousands of forest fires (2), expanding road networks (3, 4), weakened environmental laws (5, 6), and a failure to enforce environmental laws and regulations (6), is responsible. Given the staunchly pro-development policies of Brazil's current government, a coalition of key actors in the financial sector is needed to help protect the embattled Amazon rainforest.

Efforts of corporations and investors to slow Amazon deforestation are gaining momentum. On 7 July, executives of nearly 40 Brazilian corporations urged the Brazilian government to combat illegal deforestation and warned that Brazil's image and business abroad were suffering as a result (7). This plea comes on the heels of a call by 29 global investors, managing \$3.7 trillion in assets, to protect the Amazon rainforest and its Indigenous peoples (8). Global efforts to slow forest loss are also targeting corporations operating in Amazonia. In October 2019, almost 250 international investors, with \$17.2 trillion in assets, called on firms to urgently slow deforestation within their Brazilian operations and supply chains (9). Moreover, some international partners of Brazil's agribusiness, such as the European Union, are adopting measures to limit imports of commodities from Brazil that promote illegal deforestation (10).

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These corporations and investors have called for the Brazilian government to demonstrate a clear commitment to eliminating deforestation and protecting the rights of Indigenous peoples. However, the government's principal response so far—banning fires in the Amazon for 120 days (11)—will not halt or reverse the deforestation crisis. Instead, Brazil should follow the lead of investors (9) and scientists (10) who have urged the government to improve the systems that monitor Amazon land use and agricultural commodity production. Beyond this, Brazil needs to follow the scientific guidelines for conservation and sustainable use produced by the Science Panel for the Amazon—a program funded by the United Nations Sustainable Development Solutions Network that encompasses 150 authorities, including scientists, political planners, and Indigenous leaders (12).

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TECHNICAL COMMENT ABSTRACTS

Response to Comment on "Activation of methane to CH₃•: A selective industrial route to methane-sulfonic acid"

Christian Díaz-Urrutia and Timo Ott

Roytman and Singleton argue that our proposed electrophilic mechanism for the sulfonation of methane in superacid conditions is "not plausible." We clarify certain terms that might have caused misinterpretation of our proposed mechanism and supplement the discussion. We reaffirm that an electrophilic mechanism may be operative under our reaction conditions.

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